Riverfront File

Southern Region
Madison
Subpart F

Amoco Oil Company
200 East Randolph Drive
Post Office Box 6110-A
Chicago, Illinois 60680

October 31, 1984

Mr. Mark A. Haney, Manager
Groundwater Compliance Sub-Unit, DLPC
Illinois Environmental Protection Agency
2200 Churchill Road
Springfield, Illinois 62706

Dear Sir:

Shallow Groundwater Table - Amoco Wood River Sites

Enclosed is a report by our corporate Groundwater Management Section summarizing results of a subsurface investigation of the shallow groundwater table as it exists in the area of the spray pond on the main plant site and in the surge pond area on our Riverfront property. This is the report promised you in our July 23, 1984 meeting.

Please address any questions to me and I will provide contact with the Groundwater Management Section as necessary. My number is 312/856-5858.

Yours truly,

E. J. Sullivan

E. J. Sullivan
Environmental Consultant
Mail Code 1203

Enclosure

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GMS 84-453

SUBSURFACE INVESTIGATION OF THE SHALLOW GROUNDWATER TABLE IN THE SPRAY POND AND RIVERFRONT WASTE DISPOSAL AREAS, WOOD RIVER, ILLINOIS

M. S. Johnson
October 26, 1984

Abstract

An investigation of the upper groundwater table beneath wastewater disposal ponds in the riverfront and spray pond areas concludes that the shallow groundwater is discontinuous, and may not be present where an impermeable clay layer is near the surface. The presence of the upper groundwater table and the direction of groundwater flow depend on nearby sources of recharge and discharge.

Water samples from wells completed in the shallow groundwater were analyzed for dissolved hydrocarbons. Results of the analyses did not indicate concentrations above detection limits.

Based on the investigation results the Groundwater Management Section (GMS) recommends seven existing observation wells be used to monitor the upper groundwater table in the riverfront area and four existing wells be used to monitor the upper groundwater table in the spray pond area. One additional well also is recommended for the spray pond area.

Introduction

A subsurface investigation was conducted by the Groundwater Management Section (GMS) to determine the character and extent of the shallow, saturated sediments above the principal aquifer, hereafter refered to as the upper groundwater table. The investigation was initiated, as described in GMS report 84-282, to provide information for making recommendations to the Illinois Environmental Protection Agency (IEPA) for monitoring of the upper groundwater table.

Reports previously had been prepared for Amoco by Environmental Engineering, Inc., and Canonie D'Appolonia Co., that discussed the upper groundwater table in the riverfront area, but questions remained about the continuity of the water table and direction of groundwater flow. Previous data were not sufficient for characterizing the upper groundwater table in the spray pond area.

This report describes and summarizes the results of the subsurface investigation conducted by the GMS, and makes recommendations for the future monitoring of the upper groundwater table in both the riverfront and spray pond areas.

Methods of Investigation

Geologic information was obtained during drilling and installation of observation wells in the principal aquifer in August, 1984. Drilling logs of these wells along with logs of borings by John Mathes and Associates, Inc., were used to determine the depth, thickness, and character of the

shallow sediments and the impermeable clay layer separating the shallow groundwater table from the principal aquifer.

During installation of the deeper observation wells, wells also were completed in the shallow sediments above the confining clay layer, as recommended in GMS report 84-326. Depths to water subsequently were measured in these wells and in other previously-existing shallow wells in the study areas. These data were used to determine the hydraulic gradient of the upper water table. Groundwater samples were collected from these wells and analyzed for dissolved hydrocarbons in the GMS laboratory in Tulsa.

Data Analysis

Riverfront

Data from drilling of observation wells shown in Figure 1 were used in the construction of geologic cross-sections (Figure 2). The cross-sections show that the confining clay layer varies in thickness and depth from north to south in the riverfront area. During drilling, the bore holes were relatively dry in the area where the top of the clay layer was near the surface. Shallow observation wells installed near deep wells RL-7 and RL-9 were dry when measured September 11. These data indicate that where the confining clay layer is near the surface groundwater may not be present in overlying sediments.

Water-level elevations in wells completed in the upper groundwater table are shown in Figure 3. Although data were not sufficient to accurately delineate the water table, the hydraulic head differences in the wells in close proximity to the ponds suggests that flow is away from the ponds to the north and west, and that the ponds are sources of recharge to the shallow sediments. The silt and clay above the clay layer are fine-grained, and the large head difference between nearby wells is evidence that the sediments have very low permeability.

Discharge of groundwater from the shallow sediments, as suggested by the hydraulic head gradient between wells, is towards the Mississippi River west of the ponds. However, the rate of discharge probably is low because of the low permeability of the saturated sediments and is dependent on river stage and changes in water level in the ponds.

Analysis of water samples from the riverfront area indicated no dissolved hydrocarbons above detectable limits.

Spray Ponds

Geologic cross-sections constructed from drilling-log data (Figure 4) show that the depth-to and thickness-of the impermeable clay is variable in the

spray pond area (Figure 5). At most drill sites, no moisture was encountered above thirty feet in depth, and two of the four shallow observation wells (RP-7S and RP-2S) were dry when measured in September. As in the riverfront area, the upper groundwater table in the spray pond area is discontinuous, and is present only where there is sufficient thickness of silt and sand above the impermeable clay.

Groundwater-level measurements in shallow observation wells indicate a slight water-table gradient to the north, but probably the levels are dependent upon the proximity of the wells to the spray ponds. Figure 6 shows a water-level elevation difference of 2 feet from south to north (RP-2S to RP-4S). Since the upper groundwater table is discontinuous across the spray pond area, however, these data do not reflect a regional water-table gradient.

Recharge to the upper groundwater table is from seepage from the spray ponds and infiltration of precipitation. Discharge probably is by subsurface flow away from the ponds to the west and by seepage through the confining layer to the principal aquifer. Hydraulic head difference between the upper water table and the principal aquifer is approximately twenty-eight feet. } are they hydraulically connected

Analysis of water samples from shallow wells in the spray pond area indicates no dissolved hydrocarbons above detection limits.

Conclusions

Analysis of these data lead to the following conclusions:

1. The upper groundwater table is discontinuous in both the riverfront and spray pond areas, and is present only where there is sufficient thickness of silt and sand above the confining clay layer.

2. The water-table gradient of the upper groundwater is determined by the relative location of sources of recharge and discharge. In the riverfront area, shallow groundwater flows to the north and west towards the Mississippi River from the ponds. The direction of flow in the spray pond area is away from the ponds, but because the sediments are fine-grained and only partly saturated, the rate of flow and amount of discharge probably is low.

3. Dissolved hydrocarbon concentrations are below detectable limits in the upper groundwater in both the riverfront and spray pond areas.

Recommendations

Since the upper groundwater table is discontinuous, and flow is dependent on sources of recharge and discharge, locations of upgradient and downgradient wells as defined by the IEPA cannot be readily determined in either wastewater disposal area. Therefore, the GMS recommends the following monitoring program,with monitoring wells as shown in Figure 7:

1. Riverfront Area

   a. Observation wells RL-1S, RL-2S, and P-6S should be monitored because they are located between possible sources of recharge (the wastewater ponds) and discharge (the Mississippi River).

   b. Observation wells RL-4S and RL-12S also could be monitored to reflect shallow groundwater quality away from the discharge area although they are not upgradient from the ponds.

   c. Observation well P-9S and P-12S should be monitored as the upgradient wells because of their proximity to the center of the source of recharge to the upper groundwater table.

2. Spray Pond Area

   a.Observation wells RP-2S, RP4S, and B-8S should be monitored to determine water quality of the upper groundwater table downgradient from the spray ponds on each side of the ponds.

   b. An additional observation well should be installed in the area near the flare stack to monitor shallow groundwater that is flowing west from the ponds. Since well RP-3S was dry, however, there may not be enough shallow groundwater on the west side of the ponds to establish a monitoring well.

   c. Observation well H-38 should be monitored as the upgradient well in the spray pond area because, by its close proximity to the ponds, it is most representative of water recharging the upper groundwater table.

M. S. Johnson

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Table

Fluid-Level Measurements in Observation Wells
Measured September 10-11, 1984

Observation well number	Measuring Point Elevation	Depth-to Water (feet)	Water Level Elevation
RP-1	431.05	31.76	399.29
RP-2	435.63	35.92	399.71
RP-2S	435.95	7.79	428.16
RP-3	435.66	37.25	398.41
RP-3S	435.53	dry	---
RP-4	434.34	38.01	396.33
RP-4S	434.71	8.94	425.77
RP-5	432.42	36.86	395.56
RP-6	433.10	37.70	395.40
RP-7	435.42	39.23	396.19
RP-7S	435.50	dry	---
B-8S	429.19	2.27	426.92
H-38	435.12	6.24	428.88
RL-1	424.28	25.10	399.18
RL-1S	424.42	15.14	409.28
RL-2	426.82	25.42	401.40
RL-2S	426.68	16.18	410.50
RL-3	428.43	29.33	399.10
RL-4	427.54	36.75**	390.79**
RL-4S	427.55	15.50	412.05
RL-5	429.28	31.75**	397.53**
RL-6	433.46	34.77	398.69
RL-7	430.59	32.16	398.43
RL-7S	430.63	dry	---
RL-8	431.35	32.77	398.58
RL-9	430.43	30.94	399.49
RL-9S	430.56	dry	---
RL-10	427.88	27.24	400.64
RL-11S	426.85	18.69	408.16
RL-12S	426.26	16.7 *	409.56
RL-13S	429.49	dry	---
RL-14S	431.44	dry	---
P-5	436.30	30.77	405.53
P-5S	437.31	23.29	414.02
P-6S	429.64	18.5 *	411.14
P-12	422.55	22.64	399.91
P-12S	420.76	4.02	416.74

* level approximate

** level depressed by accumulated liquid hydrocarbons

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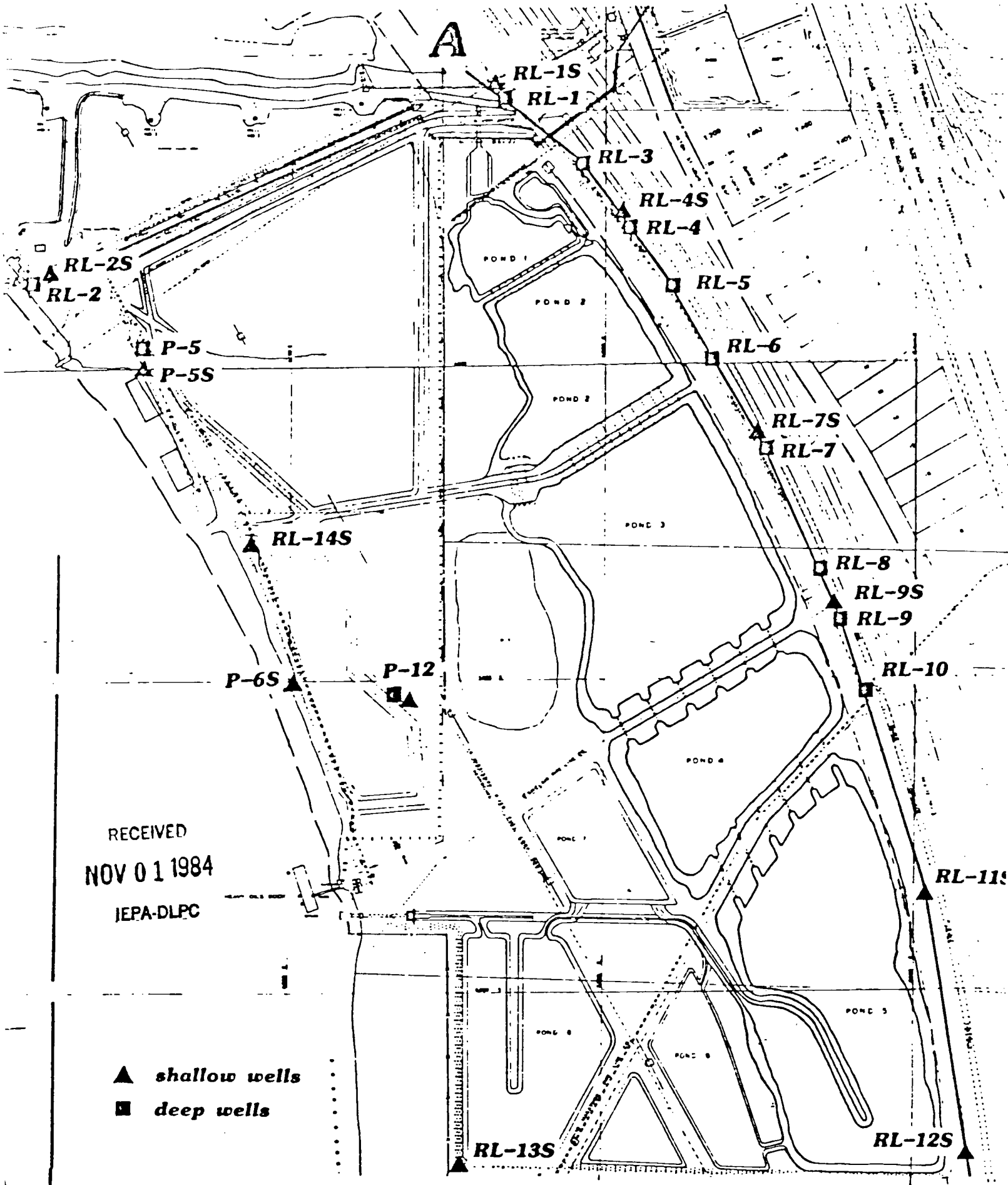

Figure 1. Observation wells in the riverfront area

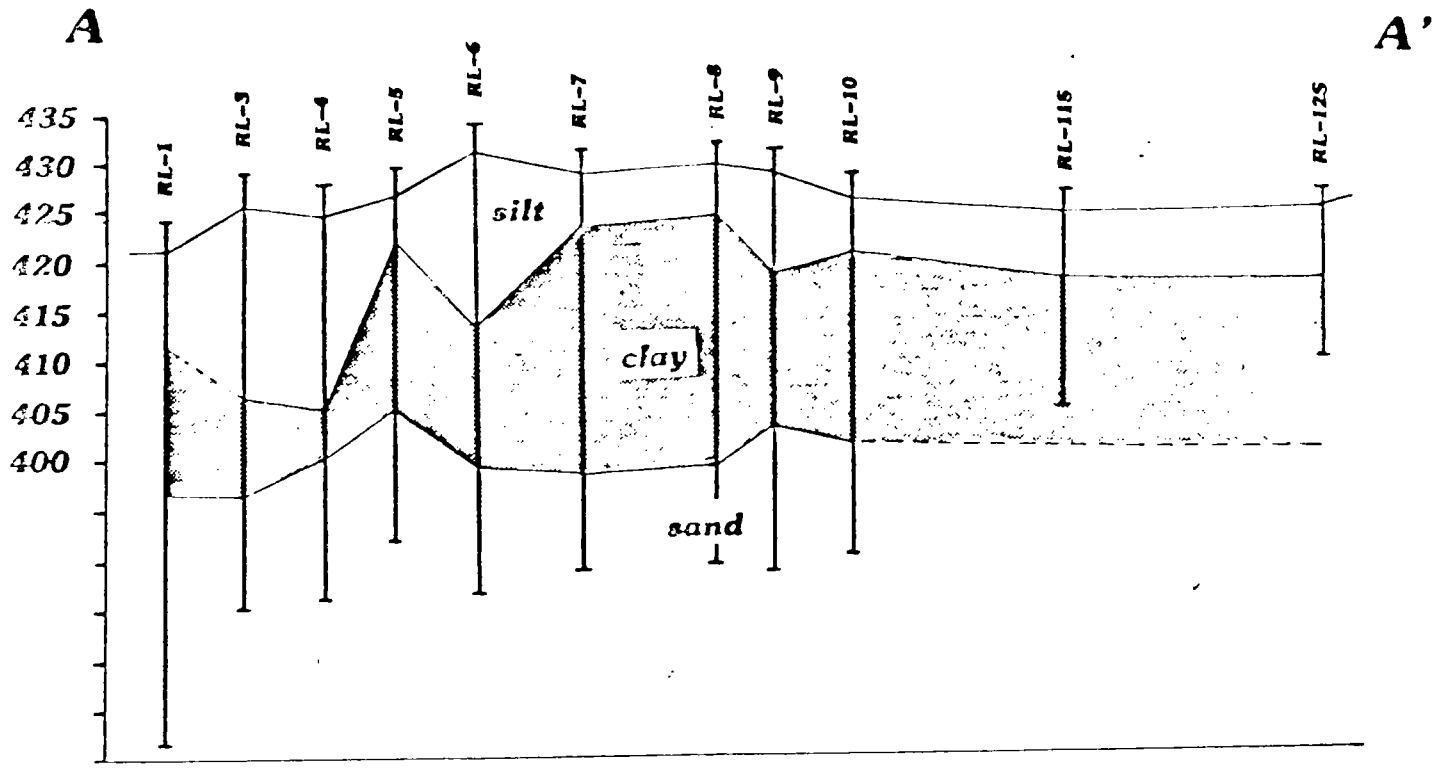

Figure 2. Geologic cross-section in the riverfront area

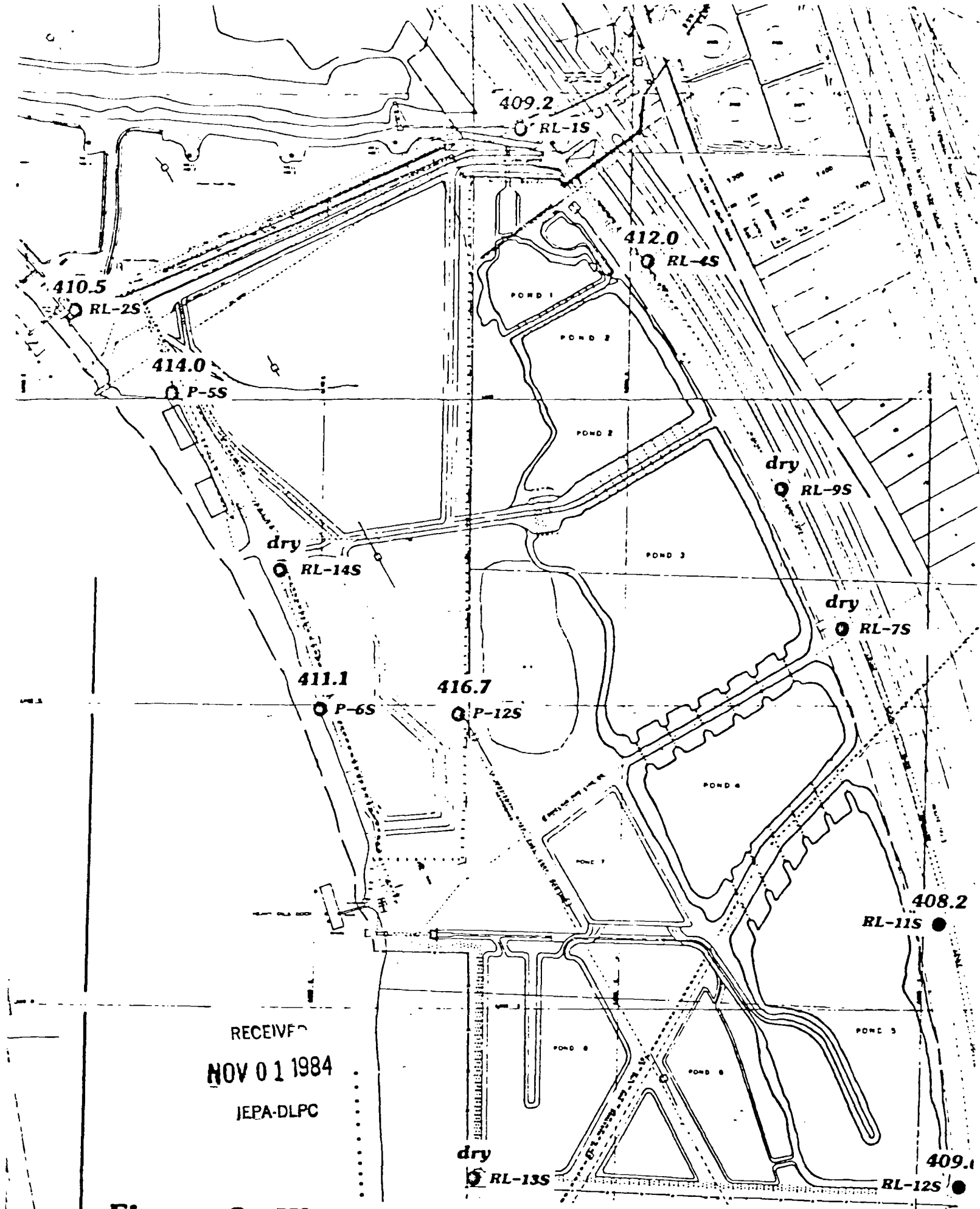

Figure 3. Water-level elevations in observation wells in the upper groundwater table

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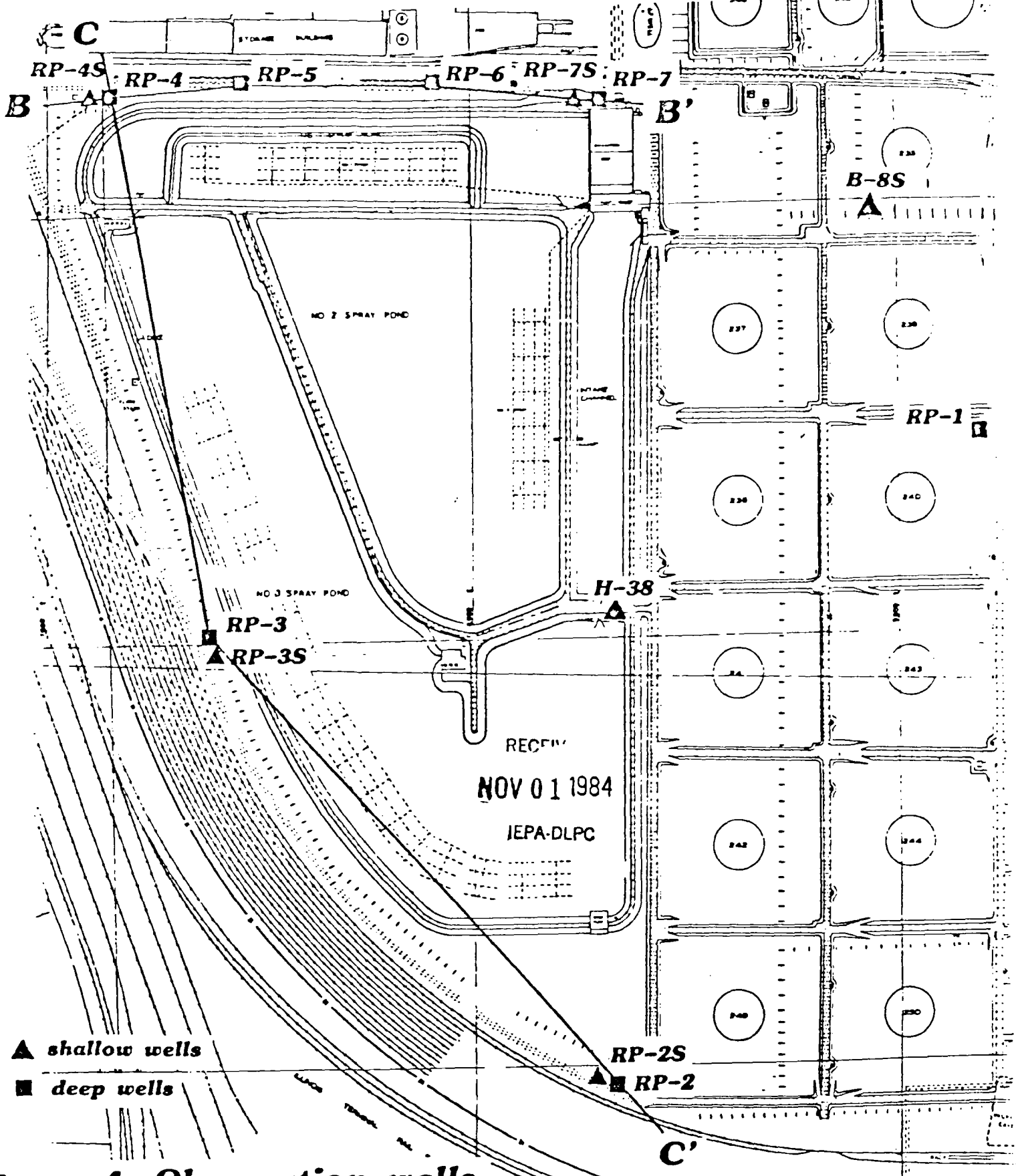
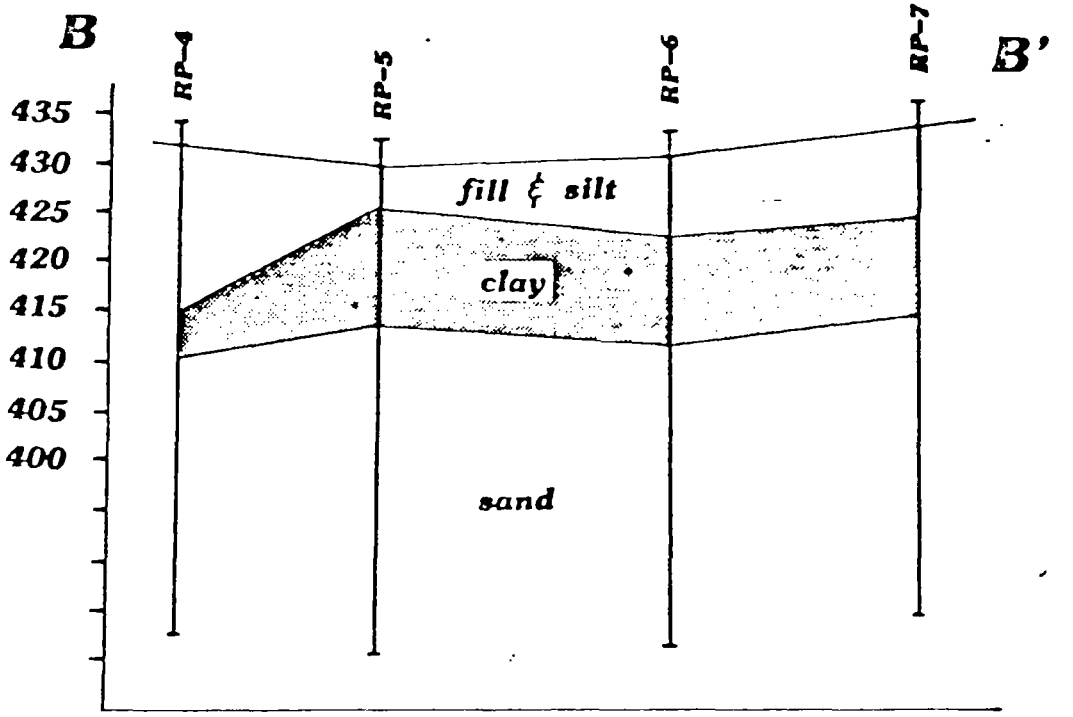


Figure 4. Observation wells in the spray pond area



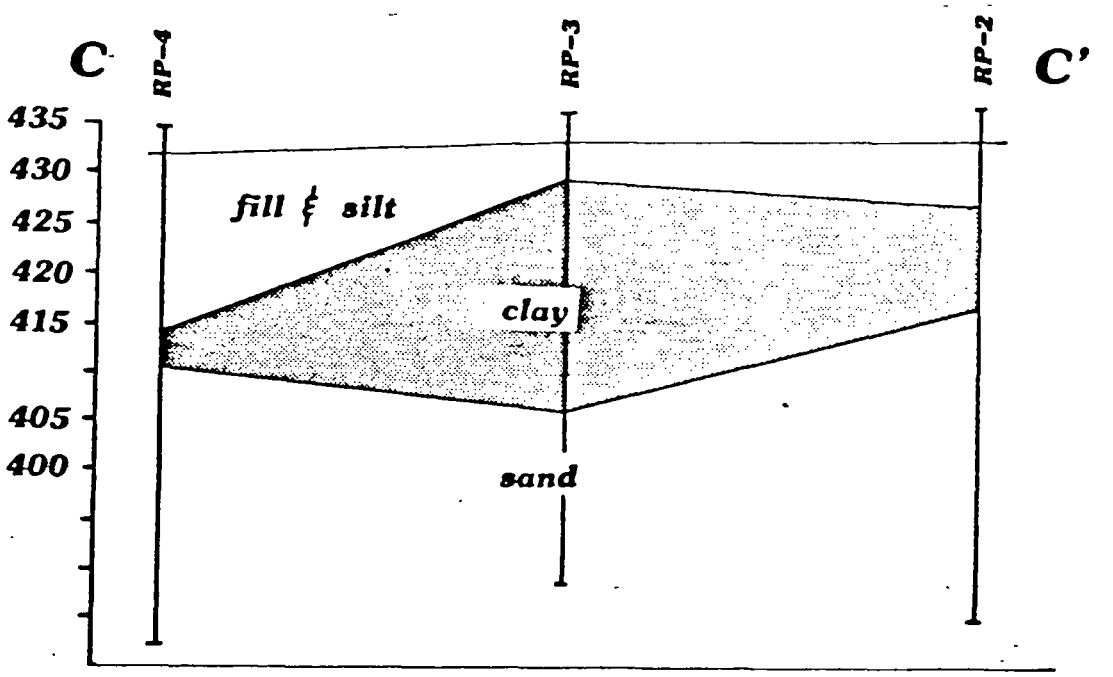


Figure 5. Geologic cross-sections in the spray pond area

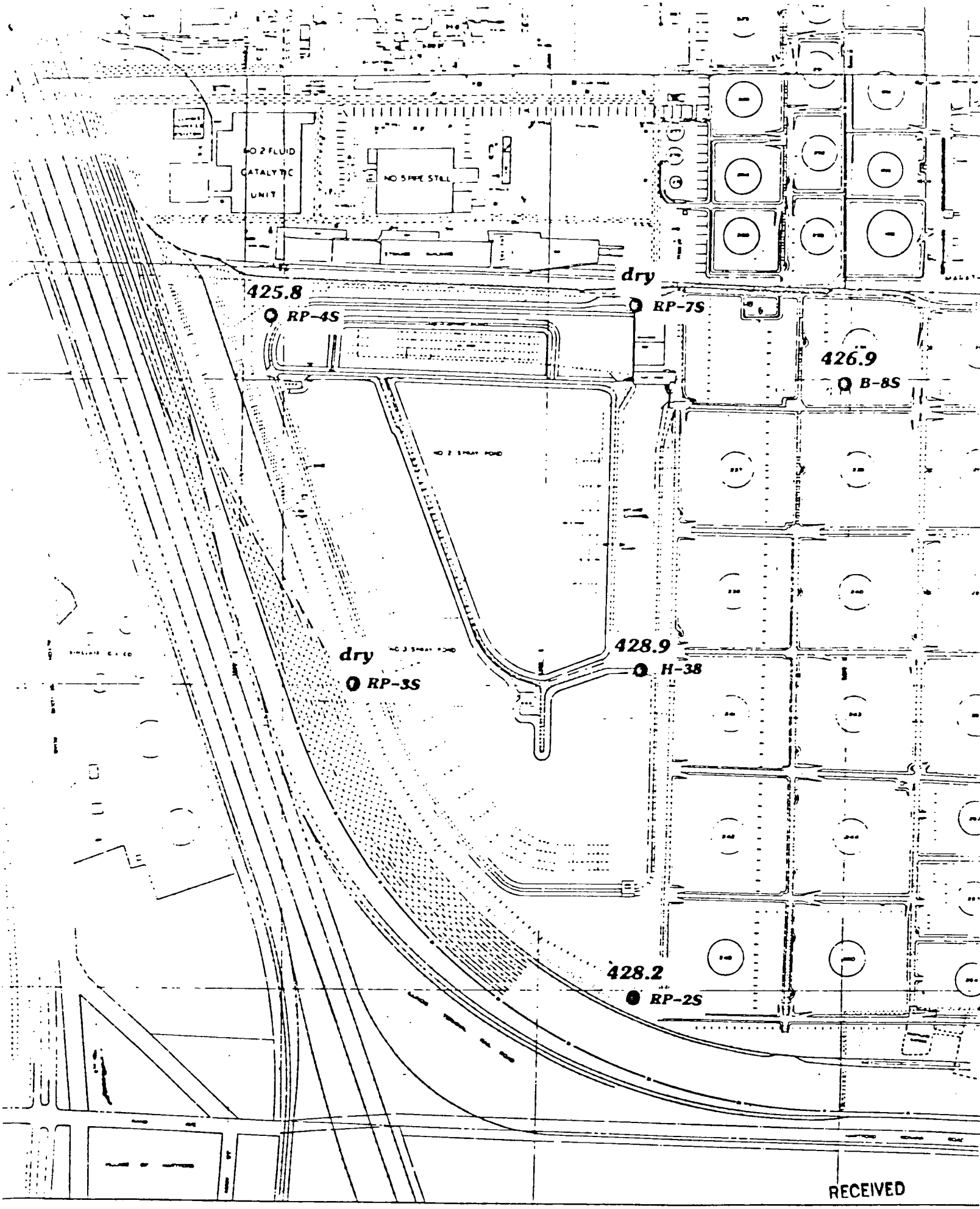


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Figure 6. Water-level elevations in observation wells in the upper groundwater table

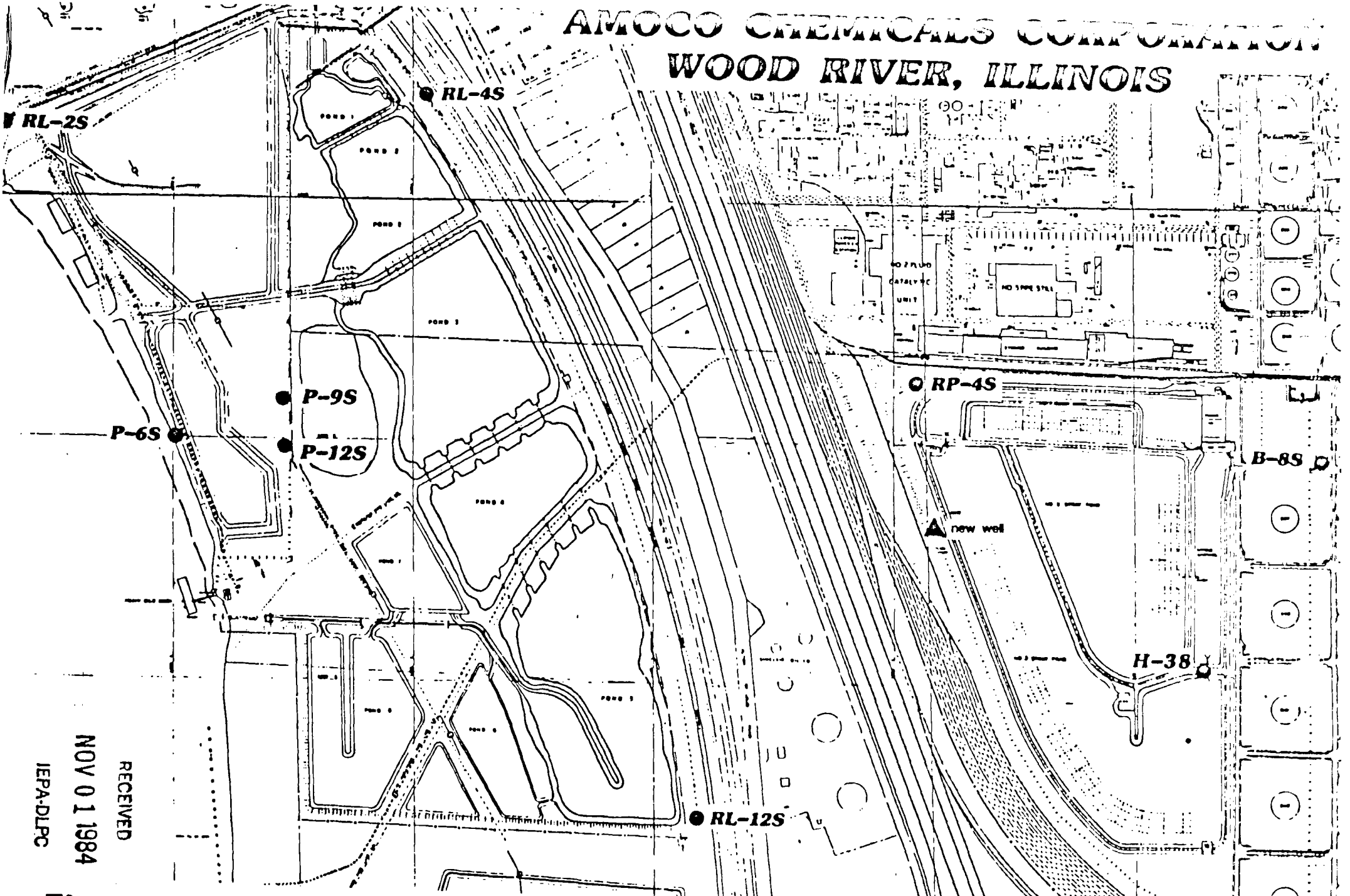

Figure 7. Locations of recommended monitoring wells in the upper groundwater table